REMARKS

Claims 1 - 9 are pending in the present application. By this Amendment, claims 1, 3, 4, 7 and 8 have been amended. No new matter has been added. It is respectfully submitted that this Amendment is fully responsive to the Office Action dated December 30, 2003.

Allowable Claim Subject Matter:

Applicant gratefully acknowledges the indication in items 4 and 5 of the Office Action that claims 5, 6 and 7, 8, respectively, would be allowable, if amended, to include all of the limitations of the base claim and any intervening claims.

However, for at least the reasons discussed below, it is respectfully submitted that all of claims 1- 9 are allowable.

As To The Merits:

As to the merits of this case, the Examiner sets forth the following rejections:

1) claims 1-4 stand rejected under 35 U.S.C. §102(b) as being anticipated by Tsang (U.S. Patent No. 5,900,623); and

2) claim 9 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Tsang in view of Pritchard (U.S. Patent No. 6,636,261).

Each of these rejections is respectfully traversed.

As explained in the specification, the reset level of the detection capacitor 18 includes a thermal noise, *i.e.* kTC noise, when the detection capacitor is rest. The thermal noise is generated in random so that the thermal noise generated at a first reset timing is different from the thermal noise at a second reset timing. According to the present invention, in order to remove this randomly generated thermal noise, the charge of the detection capacitor 18 when being reset at reset timing is converted into the reset voltage, and the charge in the detection capacitor 18 when a charge stored in the light-sensitive portion is transferred to the reset detection capacitor, following to the reset timing, is converted into the detection voltage. And the correlated double sampling circuit obtains a voltage difference between the reset voltage and the detected voltage. When the detection capacitor 18 is reset, the thermal noise is included in the charge of the detection capacitor. However, in the present invention of claim 1, such reset voltage including the thermal noise is stored in the correlated double sampling circuit, the charge stored in the light-sensitive portion is transferred to the detection capacitor after the reset, then the detected voltage including the same thermal noise and the stored charge is subtracted from the reset voltage, so that the same thermal noise is removed.

That is, according to the invention of the claim 1, the detection capacitor is reset and such reset voltage (including the thermal noise) is output, then the stored charge of the light-sensitive portion is transferred to the detection capacitor being reset after the reset and such detection voltage (including the same thermal noise) is output. The voltage difference between the reset voltage and the detection voltage is output by the correlated double sampling circuit. Therefore, the same thermal noise is removed.

On the other hand, according to Tsang, the operation is a follows. MCAP is reset at the timing A-B (see Fig. 7), then the charge of PD is transferred to MCAP during T-SHUTTER at the timing C-D, then the detected level is outputted through N4 and N5 at the timing E-G, then MCAP is again rest at the timing H-I, and the reset level is output through N4 and N5. The correlated double sampling circuit 250i output the difference between the detected level and the reset level.

However, the detected level includes a first thermal noise at the first reset of A-B and the reset level includes a second thermal noise at the second reset of H-I. Since the first thermal noise and the second thermal noise are different due to the random noise, therefore, the correlated double sampling circuit, which output the difference between the detected level including the first thermal noise and the reset including the second thermal noise, cannot remove the thermal noise appropriately. On the other hand, in the invention of claim 1, since the detected level includes the first thermal noise generated at the first reset, therefore, the correlated double sampling circuit can remove the first thermal noise.

According to the invention of the claim 4, the light-sensitive portion is depleted when being reset. This means, the light-sensitive portion does not have any thermal noise when being reset. Then, following to the reset, the charge starts to be accumulated in the depleted light-sensitive portion. Therefore, the detected level does not include any thermal noise. Tsang does not disclose that the light-sensitive portion is depleted at reset and stores a charge according to the incident light so that the charge of the light-sensitive portion without thermal noise is output.

Further, claim 7 has been amended to clarify that the cathode region 113 in Fig. 10 and 12 is depleted when reset. In addition, claim 8 has been amended to clarify that the region beneath the cathode region is depleted. This is disclosed in Fig. 10, P-well 111A being depleted.

In view of the aforementioned amendments and accompanying remarks, Applicant submits that that the claims, as herein amended, are in condition for allowance. Applicant requests such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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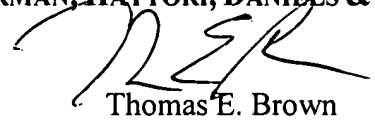

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